Airborne LiDAR investigation of Sediment flux after a Major storm event in 2003 in the Upper Saru River Catchment, Hokkaido

○Mio Kasai (Hokkaido Univ.)
Takashi Kimura (Snow Avalanche and Landslide Research Center)
Tomomi Marutani (Hokkaido Univ.)

1. INTRODUCTION

An understanding of the sediment flux in mountainous catchments requires information on both hillslope and river dynamics. While conventional methods such as aerial photographic interpretation and field survey can help with an understanding of catchment behaviour, the increasing availability of airborne LiDAR is raising expectations in terms of accurately quantifying sediment flux. In particular, integrating information on both micro and macroscopic scales seems to be opening a new era for topographic analysis, although due attention about the reliability of data is always required. This study describes changes to river form following major aggradation in the upper Saru River Catchment (380 km^2) in the Hidaka Mountain Range, Hokkaido, by analysing LiDAR data sets acquired 4 years apart. Hillslope analysis is also conducted to examine how underlying rock types modify and influence river processes. Here slope "softness" is of particular concern, for it is considered to represent the consistency of sediment supply.

2. STUDY SITE

The upper Saru River Catchment experienced a major storm event in 2003, which caused numerous landslides and aggradation throughout most of its river course (Muroran Development and Construction Department, 2004). The catchment is underlain by either sedimentary rocks, an accretionary complex, or Serpentine. Serpentine, though only occupying a part of tributaries, is particularly prone to deep-seated landslides (Hokkaido Regional Development Bureau, 2010). In areas underlain by the accretionary complex, v-shaped valleys are common, reflecting its hard and resistant lithological character.

3. METHOD

LiDAR data sets obtained in 2006 and 2010 were analyzed to assess changes in river form. Regarding hillslopes, slope angle and surface roughness were calculated from the 2010 data. Their values are assumed to reflect the softness of the underlying rocks; i.e. soft rocks should present gentle and moderately rough textures. While a 1 m DEM was employed for river analysis, a 5 m DEM was to hillslopes, as the cell-size was found to readily differentiate lithologies.

4. RESULTS AND CONCLUSION

Results showed that the dominance of either aggradation or degradation in reaches was primarily determined by the rock types through which they run. For example, channel incision was particularly intense throughout hard rock areas (Fig. 1). In addition, reaches adjacent to the outlets of tributaries largely containing soft rocks such as marine sedimentary rocks and Serpentine had experienced substantial change. There, local sediment transport capacity largely determined whether aggradation or degradation took place. This result indicates that the consistency of sediment supply from soft rock areas, together with the episodic occurrence of landslides in hard rock areas as already mentioned in the previous reports (Muroran Development and Construction Department, 2003 and 2004), must be considered when estimating future changes to river form and sediment contribution to downstream reservoirs. Compared with the river changes before 2003 reported (Muroran Development and

Construction Department, 2003), the alignment of aggradation/degradation reaches throughout the system (Fig. 1) differed after the storm event. This is probably because reaches of the river were still adjusting to changes in sediment availability in places, brought about by the event producing newly activated landslides, which caused subsequent sediment redistribution.

5. ACKNOWLEDGEMENT

Hokkaido Regional Development Bureau is very much thanked for providing LiDAR data sets.

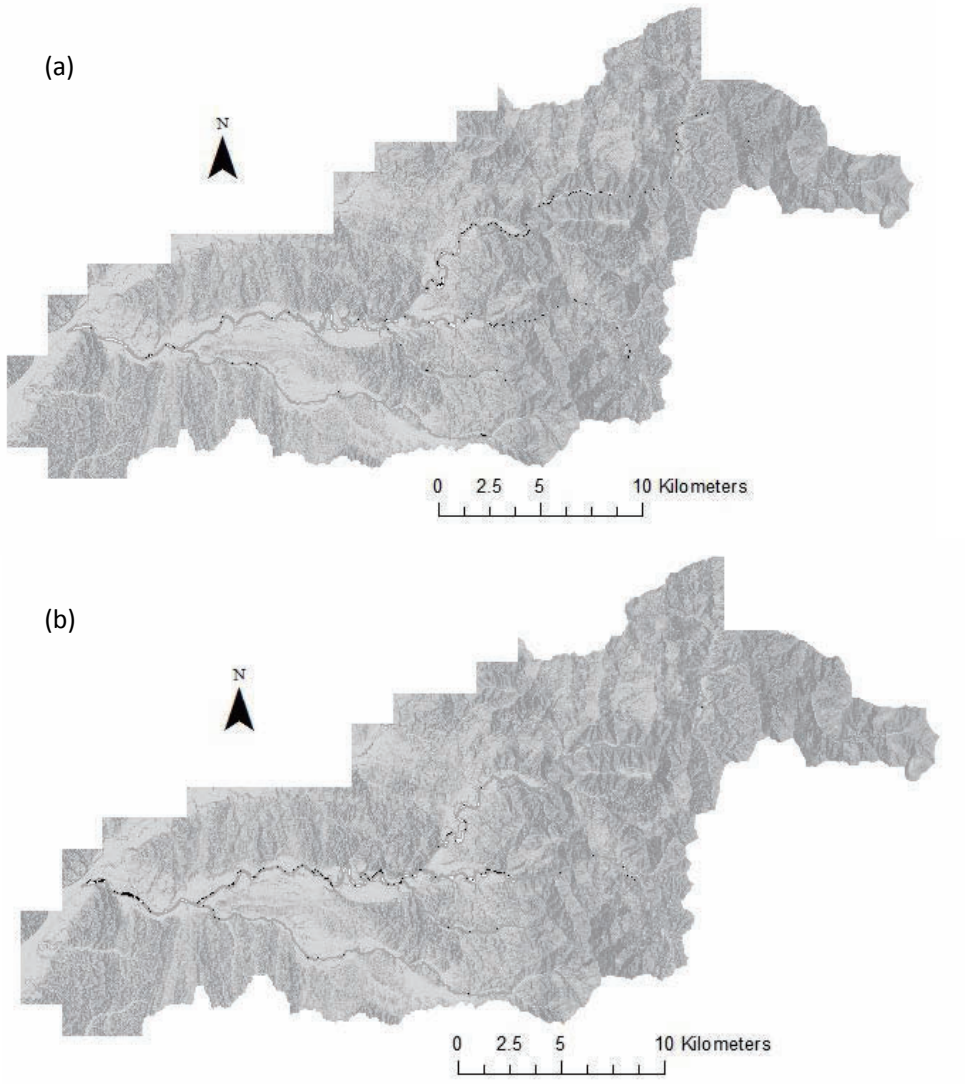

Fig. 1 Changes to river bed elevation in the upper Saru River Catchment from 2006 to 2010. Black dots along the river courses represent (a) aggradation more than 0.5 m, and (b) degradation more than 0.5 m in the period.

References

Muroran Development and Construction Department. (2003): Technical Report on Sediment Yield from Saru River Catchment: Saru River Development Project.

Muroran Development and Construction Department. (2004): Technical Report on Sediment Yield from Saru River Catchment: Saru River Development Project.

Hokkaido Regional Development Bureau. (2010): Technical Report on Occurrence Potential of Massive Landslides.